WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: A Watershed-Scale Biogeochemical Loading Model for Nitrogen and Phosphorus

Focus Categories: HYDROL, MOD, NU
Keywords: denitrification ,ecosystems, hydrologic models, geographic information systems,
land-water interactions , land use , mathematical models, rainfall-runoff processes , watershed
management
Duration: 09/00-09/03
Federal Funds Request: $216,999
Non-Federal Matching Funds Pledged: $230,945
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Abstract
We propose to develop an event-based, watershed-scale nutrient loading model with biogeochemical dynamics that is readily accessible to watershed and coastal zone managers. Utilizing commonly available software, the model will operate in a spreadsheet and will utilize an (optional) interface to GIS (which can allow the model to obtain values of spatially-relevant input parameters, and will provide visualization of model output: the simulations of water, N and P dynamics over space and time). The model will be tested initially in the Hudson/Mohawk watershed, and in the final year of the project, will be used to estimate loads of all the major drainages of the northeast US.

The modeling package will be based on hydrologic dynamics of the GWLF model (Haith and Shoemaker, 1987), but will incorporate new biogeochemical dynamics, including explicit consideration of atmospheric deposition, denitrification, and phosphorus saturation. The model structure will quantify solid-phase as well as dissolved nutrient transport processes. In developing our mechanistic model, we will utilize ideas relevant to our goals gained from the development of
SPARROW, a spatially-referenced statistical model of nutrient transport (Smith et al., 1997). While our model (like SPARROW) will not be fully spatially-explicit, links to a GIS 'pre-processor' will perform spatial analyses required to overlay land-use/soil-type categories on stream networks as needed to simulate different watershed components.

A novel aspect of the analysis is consideration of the effect of alternative land-use 'trajectories', i.e. categories of land use change over the period of the simulation, rather than fixed 'snapshots' of landuse. Maximum event loads, of particular significance to the coastal zone, will be estimated as well as seasonal and annual loads, which are available from statistical models. Annual and seasonal behavior of the model will be compared against SPARROW and other.3 models, using statistical methods developed in an earlier comparative analysis (Alexander et al., 2000b), and also compared with data from the watersheds of the northeast US. We plan to work with the *Cornell Watersheds Program*

of the University's Center for the Environment to disseminate this tool to interested environmental managers.